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New highly dispersed magnetic nano-materials as petroleum crude oil spill collector and recovery by magnetic field

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In this study, we present a novel method to prepare magnetic nano-material based on superparamagnetic iron oxide nanoparticles functionalized with natural surfactants, which can be used to recovery oil from water. The coated magnetite materials are inherently hydrophobic and oleophobic, but they can be rendered water-repellent and oil-absorbing. In this respect, the present work aims to prepare highly dispersed coated magnetite nanoparticles from Fe³⁺ having small particle size (5-25 nm) and have super paramagnetic properties. The used natural materials based on rosin, fatty acid and acrylamide polymers as coats for magnetite particles to control dispersabilities in aqueous and non-aqueous fluids, particle size and magnetism of the nano-powder materials. The possibility of recycling the beads and reclaiming the oil is also demonstrated. These materials show high performance as oil spill collector for both light and heavy crude oil at different thickness. The synthesized nanostructure consisting of coated magnetite could be used as a pollutant remedy because of its ability to adsorbing crude oil and it is maneuverable under an applied magnetism. In this work a simple undergraduate laboratory experiment to produce magnetic adsorbents is described. The high partitioning of these materials between water and oil assist to enhance crude oil productivity due to their ability to affect the reservoir rocks. Detailed microscopic and wettability studies reveal that the combined effects of the surface morphology and of the chemistry of the functionalized magnetite greatly affect the oil-absorption dynamics. In particular, nanoparticle capping molecules are found to play a major role in this mechanism.

Biography

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Molecular characterization of circulating tumor cells using iron-oxide nanoparticles and micro-nuclear magnetic resonance

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Molecular profiling of circulating tumor cells (CTC) in peripheral blood offers a valuable and non-invasive method for cancer detection and monitoring of the disease. Through the synergistic integration of microfabrication, nanosensors, and novel chemistries, we have developed the micro-nuclear magnetic resonance (μ NMR) platform. Preclinical and clinical data demonstrate that μ NMR is able to target specific tumor cells among circulating peripheral blood cells, and it performs superior to the FDA-approved methodology established for the detection of CTC. μ NMR appears to be a sensitive, point-of-care, and non-invasive adjunct in detection and diagnosis of cancer.

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